22nd International Conference on
Solid State Ionics

Program Book

평창 2019

SSI

Solid State Ionics

June 16(Sun)-21(Fri), 2019

PyeongChang Alpensia Resort, Korea

PROGRAM DETAILS

Poster Presentation

June 17(Mon)

Poster Number	Paper Title	Presenter	Organization
P-MON-184	Microstructural and Electrochemical Properties of Impregnated $La_{0.4}Sr_{0.6}Ti_{0.8}Mn_{0.2}O_{3\pm d}$into a Partially Removed Ni SOFC Anode Substrate	Jung Hyun Kim	Hanbat National Univ.
P-MON-185	X-ray Photoelectron Spectroscopic Study of Impregnated $La_{0.4}Sr_{0.6}Ti_{0.8}Mn_{0.2}O_{3\pm d}$ Anode Material for High Temperature-operating Solid Oxide Fuel Cell	Jung Hyun Kim	Hanbat National Univ.
P-MON-186	Microstructural Effect on Charge Relaxation Phenomenon of Doped Ceria as Electrolyte for IT-SOFCs	Smita Atul Acharya	RTMNU
P-MON-187	Investigation of potential catalytic compounds for direct synthesis of methane from H_2O-CO_2 co-electrolysis	Beata Maria Bochentyn	Gdansk Univ. Tech.
P-MON-188	Electrochemical CO_2 Hydrogenation to Syn-Fuels at Atmospheric Pressure in co-Ionic Membrane Reactors	Ioannis Garagounis	Aristotle Univ. of Thessaloniki
P-MON-189	Augmenting the catalytic activity of Pt-CeO_2 catalyst by heat treatment in H_2 atmosphere for CO oxidation	Asif Jan	KIST
P-MON-190	Atomistic investigation of doping effects on electrocatalytic properties of cobalt oxides for water oxidation	Byunghoon Kim	Seoul National Univ.
P-MON-191	Surface and Interface Studies of Ni doped BZY for Catalysis Applications	Dylan Jennings	Colorado School of Mines
P-MON-192	Steam reforming of methane at low-temperature supported by bimetallic catalysts for high fuel utilization of proton-conducting ceramic fuel cells	Kyungpyo Hong	Yonsei Univ.
P-MON-193	Real-time control of size distribution of cobalt nanoparticles grown on ceria surface for CO oxidation	Sangwoo Kim	KAIST
P-MON-194	Exploration of the reaction pathway of ceria-based catalyst for CH_4 conversion	Siwon Lee	KAIST
P-MON-195	Reaction kinetics of catalytic dry reforming of methane on Ni/Al_2O_3 at low-temperature using an in-situ stagnation-flow reactor	Yonggyun Bae	Yonsei Univ.
P-MON-196	Tuning the efficiency of oxygen evolution catalyst with alkaline ions	Hyunah Kim	Seoul National Univ.
P-MON-197	Feasibility of Ni-based bimetallic catalysts anchored on ceramic supports for dry reforming of methane at low-temperature	JeongA Lee	Yonsei Univ.
P-MON-198	Nickel catalyst generated by perovskite exsolution for enhanced CO oxidation	Rui Huang	POSTECH
P-MON-199	Long-term Thermal Stability of Pt@SiO_2 Catalyst in High—temperature CH_4 Combustion	Seunghyun Kim	KAIST
P-MON-200	Atomic-Resolution Operando Study of Triple-Phase Boundary Dynamics during Catalytic Oxidation Reactions	Peter A. Crozier	Arizona State Univ.
P-MON-201	Oxygen-Deficient $(Nd_{0.4}Sr_{0.6})_2Ni_{0.8}M_{0.2}O_{4-\delta}$ Nickelates as Oxygen Electrode Materials for SOFC/SOEC	Aleksey Yaremchenko	CICECO - Aveiro Institute of Materials, Univ. Aveiro
P-MON-202	Oxygen transport properties and in-situ characterization of $La_{0.75}X_{0.25}Cr_{0.5}Mn_{0.5}O_3$ (X = Sr, Ca)	Caroline Pirovano	ENSCL / Univ. de Lille

Oxygen-Deficient $(Nd_{0.4}Sr_{0.6})_2Ni_{0.8}M_{0.2}O_{4-\delta}$ Nickelates as Oxygen Electrode Materials for SOFC/SOEC

Aleksey Yaremchenko[(a)], Blanca I. Arias-Serrano[(a)], Ekaterina Kravchenko[(b)], Kiryl Zakharchuk[(a)], Jekabs Grins[(c)], Gunnar Svensson[(c)], Vladimir Pankov[(b)]*

[(a)] CICECO - Aveiro Institute of Materials, DEMAC, University of Aveiro, Aveiro, Portugal
[(b)] Faculty of Chemistry, Belarusian State University, Minsk, Belarus
[(c)] Department of Materials and Environmental Chemistry, Stockholm University, Sweden
* ayaremchenko@ua.pt

Abstract

Perovskite-related $Ln_2NiO_{4+\delta}$ (Ln = La, Pr, Nd) nickelates with layered Ruddlesden-Popper combine redox stability with noticeable oxygen stoichiometry changes, yielding enhanced mixed transport and electrocatalytic properties. These unique features are promising for applications as oxygen electrodes with good electrochemical performance in reversible SOFC/SOEC (solid oxide fuel/electrolysis cell) systems. To date, most efforts were focused on oxygen-hyperstoichiometric $Ln_2NiO_{4+\delta}$-based phases, whereas nickelates with oxygen-deficient lattice remain poorly explored. Recent studies demonstrated that the highest electrical conductivity in $(Ln_{2-x}Sr_x)_2NiO_{4\pm\delta}$ series at elevated temperatures is observed for the compositions containing ~ 60 at.% of strontium in A sublattice [1,2]. The present work was focused on the characterization of $(Nd_{0.4}Sr_{0.6})_2Ni_{0.8}M_{0.2}O_{4-\delta}$ (M = Ni, Co, Fe) nickelates for the possible use as materials for reversible oxygen electrodes.

The ceramic materials were prepared by Pechini method with repeated annealings at 650-1200°C and sintered at 1250-1300°C for 5 h under oxygen atmosphere. Variable-temperature XRD studies confirmed that all studied compositions retain tetragonal K_2NiF_4-type structure in the temperature range 25-900°C. The results of thermogravimetric analysis showed that the prepared nickelates has oxygen-deficient lattice under oxidizing conditions at temperatures above 700°C. Partial substitution of nickel by cobalt or iron results in a decrease of *p*-type electronic conductivity and the concentration of oxygen vacancies in the lattice, but also suppresses dimensional changes associated with microcracking effects (due to anisotropic thermal expansion of tetragonal lattice). Electrochemical performance of porous $(Nd_{0.4}Sr_{0.6})_2Ni_{0.8}M_{0.2}O_{4-\delta}$ electrodes in contact with $Ce_{0.9}Gd_{0.1}O_{2-\delta}$ solid electrolyte was evaluated at 600-800°C employing electrochemical impedance spectroscopy and steady-state polarization (anodic and cathodic) measurements.

[1] E. Kravchenko, D. Khalyavin, K. Zakharchuk, J. Grins, G. Svensson, V. Pankov, A. Yaremchenko, J. Mater. Chem. A 3 (2015) 23852.
[2] E. Kravchenko, K. Zakharchuk, A. Viskup, J. Grins, G. Svensson, V. Pankov, A. Yaremchenko, ChemSusChem 10 (2017) 600.